

The Millennium Cohort Study

DoD Center for Deployment Health Research
PO Box 85122, San Diego, CA 92186
(888) 942-5222

www.millenniumcohort.org



- Background:** In the late 1990s, the US Department of Defense and Congress identified the need for coordinated epidemiological research to determine how military occupational exposures, including deployment-related exposures, affect long-term health. The Institute of Medicine more specifically defined the importance of a large, prospective study for evaluating exposures and a broad spectrum of important health outcomes. The Millennium Cohort Study was designed, in collaboration with all military services and the Department of Veterans Affairs, to meet these research challenges.
- Objective:** The primary study objective is to evaluate the impact of military service, including deployments and other occupational exposures, on long-term health. Important health outcomes include all objective diagnoses, as well as subjective measures of symptoms and functional health.
- Approach:** Launched in the summer of 2001, the Millennium Cohort Study began enrolling a representative sample of US military personnel, both active duty and Reserve/Guard members, who agreed to participate in follow-up well past their time in service, for up to 21 years. Currently, Panel 1 includes more than 77,000 participants and Panel 2 includes an additional 31,100. Panel 3, who will begin enrolling in 2007, is anticipated to include more than 39,000 participants. All participants provide important information on exposures and health through and beyond their time in service. Information is maintained confidentially and securely. The Millennium Cohort Study was designed to conclude follow-up in 2022.
- Value:** Although the original designers of the Millennium Cohort Study could not foresee the post-2001 military conflicts, the project is perfectly positioned to address health outcomes related to these operations. More than 40% of Millennium Cohort participants have deployed in support of the Global War on Terrorism. Millennium Cohort investigators are able to evaluate, prospectively, detailed data from before, during, and long after these deployments.
- Collaboration:** Investigators include scientists from the Army, Navy, Air Force, Department of Veterans Affairs, and leading academic institutions. The Millennium Cohort Scientific Steering and Advisory Committee includes many distinguished external scientists and representatives from leading Veterans Service Organizations.
- Support:** The project is supported by the US Department of Defense, Military Operational Medicine Research Program. DMDC Reference #00-0019. RCS #DD-HA(AR)2106. OMB approval #0720-0029.
- Contacts:** The Principal Investigator of the Millennium Cohort Study is Dr. Tyler Smith, and the primary performing site is the DoD Center for Deployment Health Research in San Diego, CA. The study team can be contacted (toll-free) at 1-888-942-5222, DSN 553-7465 or email info@millenniumcohort.org. More information is also available on the website, www.millenniumcohort.org

Millennium Cohort Study Products

The investigative team has shared more than fifty presentations at scientific conferences since 2001, and received nine research awards. Below represents a chronologic list of publications in the medical literature. Many additional products are under development and review.

Smith B, Wingard DL, Ryan MAK, Macera CA, Patterson TL, Slymen DJ, for the Millennium Cohort Study Team. **US military deployment during 2001-2006: comparison of subjective and objective data sources in a large prospective health study.** Annals of Epidemiology. 2007; In press.

Defining military deployments using multiple data sources is examined. Deployment timing and duration metrics, critical for epidemiological studies, are valid in the Millennium Cohort Study.

Smith B, Smith TC, Gray GC, Ryan MAK, for the Millennium Cohort Study Team. **When epidemiology meets the Internet: Web-based surveys in the Millennium Cohort Study.** American Journal of Epidemiology. 2007; In press.

Optimal use of the Internet - with minimal response bias, maximum cost-savings, and improved data - is highlighted.

LeardMann CA, Smith B, Smith TC, Wells TS, Ryan MAK, for the Millennium Cohort Study Team. **Smallpox vaccination: comparison of self-reported and electronic vaccine records in the Millennium Cohort Study.** Human Vaccines. 2007;3(6).

Self-report of smallpox vaccination is very reliable. Results may be valuable in supporting global response to bioterrorism threats.

Smith TC, Jacobson IG, Smith B, Hooper TI, Ryan MAK, for the Millennium Cohort Study Team. **The occupational role of women in military service: validation of occupation and prevalence of exposures in the Millennium Cohort Study.** International Journal of Environmental Health Research. 2007 Aug;17(4):271-84.

Data on women's occupations are reliable, and occupational codes can be well correlated with exposures of concern. This was an award-winning presentation at a Navy conference in 2006.

Smith TC, Smith B, Jacobson IG, Corbeil TE, Ryan MAK, for the Millennium Cohort Study Team. **Reliability of standard health assessment instruments in a large, population-based cohort study.** Annals of Epidemiology. 2007 Jul;17(7):525-32.

Reliability metrics, by test-retest concordance and internal consistency, are extremely strong in Millennium Cohort Study data.

Smith B, Leard CA, Smith TC, Reed RJ, Ryan MAK, for the Millennium Cohort Study Team. **Anthrax vaccination in the Millennium Cohort: validation and measures of health.** American Journal of Preventive Medicine. 2007 Apr;32(4):347-53.

The largest ever evaluation of this topic, revealed strong validity of self-reported vaccination, as well as unique health features of the small subset who may misreport vaccination. This work won awards at two research conferences in 2006.

Chretien JP, Chu LK, Smith TC, Smith B, Ryan MAK, for the Millennium Cohort Study Team. **Demographic and occupational predictors of early response to a mailed invitation to enroll in a longitudinal health study.** Biomed Central Medical Research Methodology. 2007;7:6.

Those who respond first to study invitations, whether to participate or decline, have distinct characteristics within the study population. This information can help structure recruitment efforts. ²

Ryan MA, Smith TC, Smith B, Amoroso P, Boyko EJ, Gray GC, Gackstetter GD, Riddle JR, Wells TS, Gumbs G, Corbeil TE, Hooper TI. **Millennium Cohort: enrollment begins a 21-year contribution to understanding the impact of military service.** Journal of Clinical Epidemiology. 2007 Feb;60(2):181-91.

A foundation report, this describes original enrollment methods and challenges of the Millennium Cohort Study. Characteristics of the first 77,047 participants are detailed and shown to strongly represent the population-based sample of the US military from which they were drawn.

Riddle JR, Smith TC, Smith B, Corbeil TE, Engel CC, Wells TS, Hoge CW, Adkins J, Zamorski M, Blazer D; for the Millennium Cohort Study Team. **Millennium Cohort: the 2001-2003 baseline prevalence of mental disorders in the U.S. military.** Journal of Clinical Epidemiology. 2007 Feb;60(2):192-201.

The baseline prevalence of mental disorders in this 22-year longitudinal study compares favorably with other civilian and military populations.

Smith TC, Smith B, Corbeil TE, Ryan MAK, Riddle JR, for the Millennium Cohort Study Team. **Impact of terrorism on caffeine and tobacco use** [letter in response to "Self-reported mental health among US military personnel, prior and subsequent to the terrorist attacks of September 11, 2001"]. Journal of Occupational and Environmental Medicine. 2004 Dec;46(12):1194-5.

Authors of a previously highlighted article respond to important suggestions on future analyses.

Smith TC, Smith B, Corbeil TE, Riddle JR, and Ryan MAK, and the Millennium Cohort Study Team. **Self-reported mental health among US military personnel, prior and subsequent to the terrorist attacks of September 11, 2001.** Journal of Occupational and Environmental Medicine. 2004 Aug;46(8):775-82.

Accepted without revision and featured by journal editors, this early analysis leveraged Millennium Cohort data to conclude that military members displayed stronger mental health characteristics soon after the terrorist attacks of September 11, 2001. The authors suggest this may be attributed to resilience and/or an outpouring of support for the US military mission.

Gray GC, Chesbrough KB, Ryan MAK, Amoroso P, Boyko EJ, Gackstetter GD, Hooper TI, Riddle JR, for the Millennium Cohort Study Group. **The Millennium Cohort Study: A 21-year prospective cohort study of 140,000 military personnel.** Military Medicine. 2002 Jun;167(6):483-8.

The origins and development of the Millennium Cohort Study are described. The largest prospective study in military history was established to answer the most difficult questions about long-term health after military service.

ACKNOWLEDGMENTS

We are especially indebted to all Millennium Cohort Study participants for their contributions to this study.

Millennium Cohort Study Executive Committee

COL Paul J. Amoroso, MC, USA, Dept of Clinical Investigation, Madigan Army Medical Center, Tacoma, WA

Edward J. Boyko, MD, MPH, VA Epidemiology Research Information Center, Univ Washington, Seattle, WA

Gary D. Gackstetter, DVM, MPH, PhD, ANSER, Inc., Washington DC

Gregory C. Gray, MD, MPH, College of Public Health, University of Iowa, Iowa City IA

Tomoko I. Hooper, MD, MPH, Dept of Preventive Medicine and Biometrics, USUHS, Bethesda MD

James R. Riddle, DVM, MPH, Colonel, US Air Force, Biomedical Science Corps (retired)

CDR Margaret A. K. Ryan, MC, USN, Naval Hospital, Camp Pendleton, CA

Tyler C. Smith, MS, PhD, DoD Center for Deployment Health Research, NHRC, San Diego CA

Col Timothy S. Wells, USAF, BSC, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH

Scientific Steering and Advisory Committee

Dr. Elizabeth Barrett-Connor, University of California, San Diego CA

Dr. Dan Blazer, Duke University Medical Center, Durham NC

Dr. Harold Koenig, Vice Admiral, US Navy (retired), Edward Martin & Associates, San Diego, CA

Mr. Michael O'Rourke, Veterans of Foreign Wars, Washington DC

Dr. Larry Palinkas, University of Southern California, Los Angeles CA

Mr. Al Pavich, Vietnam Veterans of San Diego, San Diego CA

Dr. Michael Peddecord, School of Public Health, San Diego State University, San Diego CA

Mr. Joe Sharpe, The American Legion, Washington DC

Dr. G. Marie Swanson, Indiana University, Terra Haute IN

Research Team at the DoD Center for Deployment Health Research, NHRC, San Diego CA

Gina Creaven, MBA, Fiscal Manager; James Davies, Fiscal Administrator; Skye Endara, Data Analyst Intern; Lacy Farnell, Assistant Study Coordinator; Gia Gumbs, MPH, Research Consultant; Isabel Jacobson, MPH, Biostatistician; Cynthia LeardMann, MPH, Biostatistician; Travis Leleu, IT Specialist; Jamie McGrew, Research Assistant; Robb Reed, MS, Research Assistant; Besa Smith, MPH, PhD, Biostatistician; Kathy Snell, Research Assistant; Steven Speigle, Data Manager; Kari Welch, MA, Study Coordinator; Jim Whitmer, Data Manager; Charlene Wong, MPH, Data Analyst; Lauren Zimmerman, Data Analyst Intern

Information updated August 2007